



# Ultracur3D<sup>®</sup> EL 4000

Flexible | 90 A | Clear

## Extended TDS

Complete Technical Documentation  
and Testing Summary

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# Technical Data Sheet

**Flexible resin with superior strength, rebound and high hardness (Shore 90 A).**

The data contained in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, this data does not relieve processors from carrying out their own investigations and tests; neither does this data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose.

Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed.

The safety data given in this publication is for informational purposes only and does not constitute a legally binding MSDS. The relevant MSDS can be obtained upon request from your supplier or you may contact Forward AM Technologies GmbH directly at [sales@forward-am.com](mailto:sales@forward-am.com).

General Properties	Method	Typical Values
Appearance	-	Clear
Viscosity, 25°C	Cone/Plate Rheometer <sup>1)</sup>	470 mPas
Viscosity, 30°C	Cone/Plate Rheometer <sup>1)</sup>	350 mPas
Density (Printed Part)	ASTM D792	1.13 g/cm <sup>3</sup>
Density (Liquid Resin)	ASTM D4052-18a	1.06 g/cm <sup>3</sup>
Tensile Properties <sup>2)</sup>	Method	Typical Values
Ultimate Tensile Strength	ASTM D412 C	11 MPa
Elongation at Break	ASTM D412 C	170%
Impact Properties	Method	Typical Values
Unnotched Izod, 23°C	ASTM D4812	No break
Mechanical Properties	Norm	Typical Values
Tear Strength (Graves)	ASTM D624 type C	37 N/mm
Tear Strength (Trouser)	ASTM D624 type T	3 kN/m
Rebound Resilience	ASTM D7121	30%
Relative Abrasion Loss	ISO 4649	575 mm <sup>3</sup>
Compression set at 23°C, 72h (constant force)	ASTM D395-A	8%
Compression set at 23°C, 72h (constant deflection)	ASTM D395-B	60%
Rosflex, 23°C, 60° angle	ASTM D1052 (2 mm)	>20.000 Cycles (no crack propagation)

Thermal Properties	Method	Typical Values
Glass transition temperature (DMA, tan(d))	ASTM D4065	-15°C
Vicat temperature <sup>3)</sup>	ASTM D1525	83°C
Biocompatibility	Method	Typical Values
Cytotoxicity – Neutral Red	EN ISO 10993-5 (2009)	PASS <sup>4)</sup>
Other	Method	Typical Values
Hardness Shore D	ASTM D2240	90
Water Absorption, Short-Term (24 hours)	ASTM D570	2.3%

#### Mechanical properties overview

- 1) Determined with TA-Instrument DHR rheometer, cone/plate, diameter 60 mm, shear rate 100 s<sup>-1</sup>
- 2) Pulling speed 500 mm/min
- 3) 120 K/h, 10N
- 4) For the statement on Biocompatibility data see Chapter: [Biocompatibility](#).
- 5) If not noted otherwise, all specimens are 3D printed. Samples were tested at room temperature, 23°C. ASTM sample size (L x W x H): D4812 63 x 3.2 x 12 mm, ASTM D1052 150 x 2 x 20 mm

## Printing Performance

The combination of 3D printer and material has a huge impact on the quality of the parts produced. The measured lattice design characteristics can be found in the [Design Guidelines for Lattice Structures of Ultracur3D® Resins](#).

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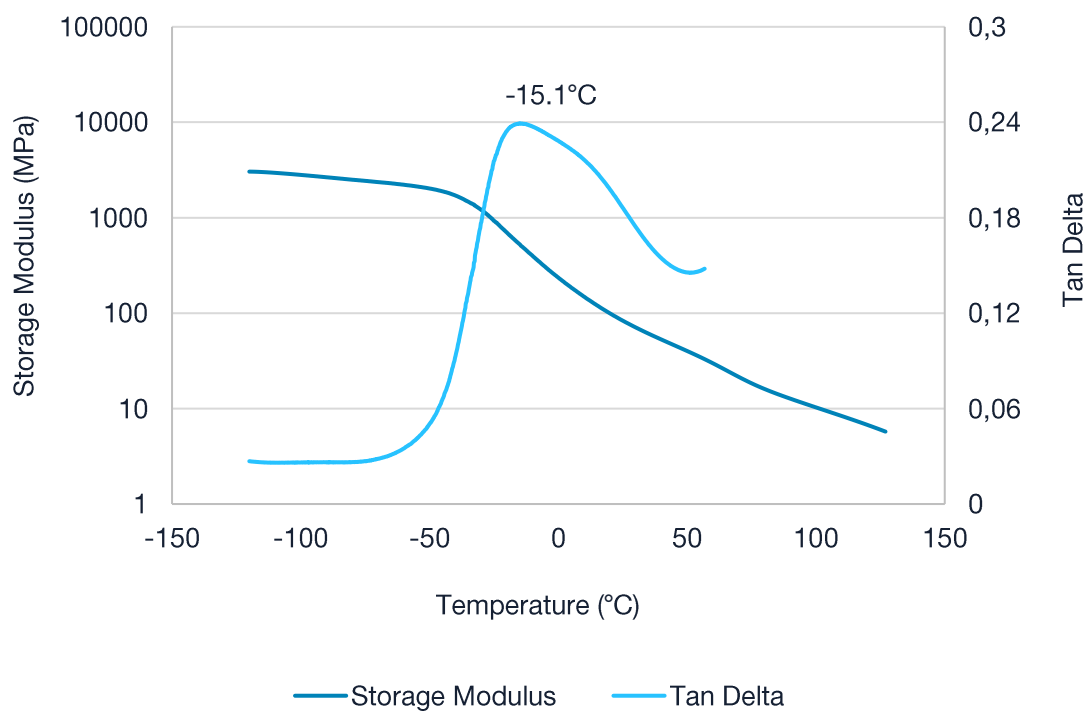
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## Dynamic Mechanical Analysis (DMA)

In this DMA measurement, a cyclic strain is applied to the sample, and the response of the sample is recorded as a function of temperature. This can give a good impression of the changes in material behavior, both at low and high temperatures. The measured Storage modulus is a good indication of the stiffness of the material. The maximum in Tan Delta gives the glass transition temperature.

	Setting
Measurement	Strain-controlled
Temperature sweep	3°C / min
Strain	0.25% (linear viscoelastic regime)
Type of loading	Single cantilever
Frequency	1 Hz

Testing conditions DMA



DMA curve

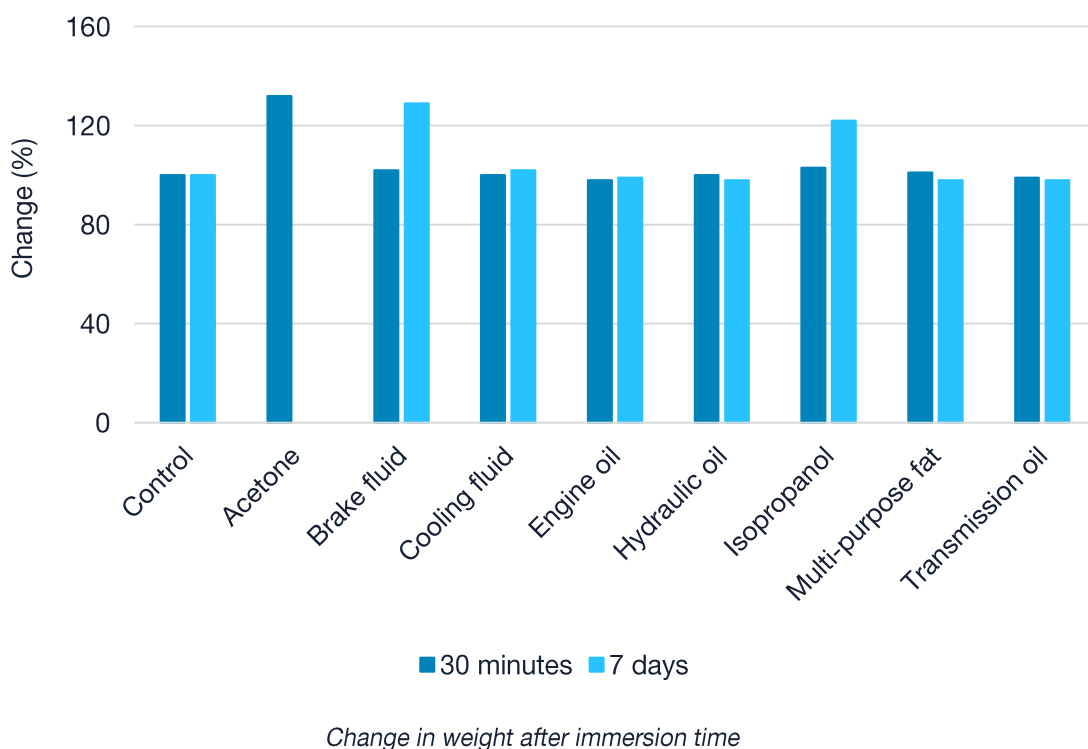
# Industrial Chemical Resistance

The resistance of resin materials against chemicals, solvents and other contact substances is an important criterion of selection for many industrial applications. General chemical resistance depends on the period of exposure, the temperature, the quantity, the concentration and the type of the chemical substance. When exposed to industrial chemicals, the chemical bonds of photopolymers can break or degrade, causing a change in the mechanical properties.

## Test Method and Specimens

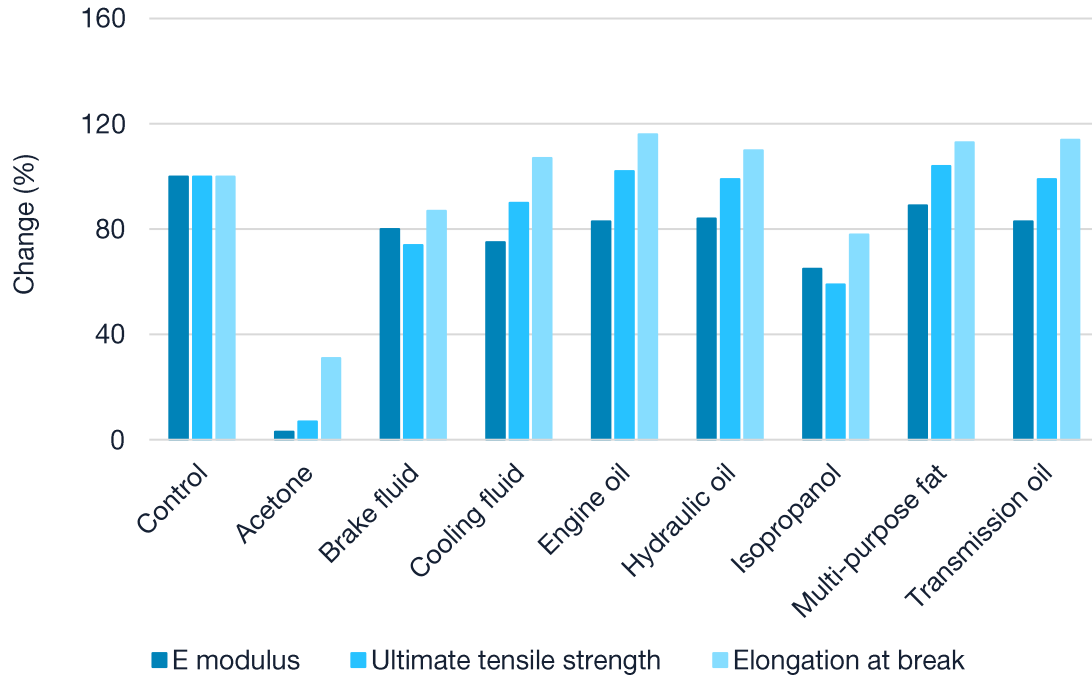
ASTM D412 C tensile bars were soaked in each fluid at room temperature, one set for 30 minutes and one set for 7 days. Upon completion of the soaking time, the parts were removed from the test fluid and were dried to measure the weight and the mechanical properties.

## Weight Measurement



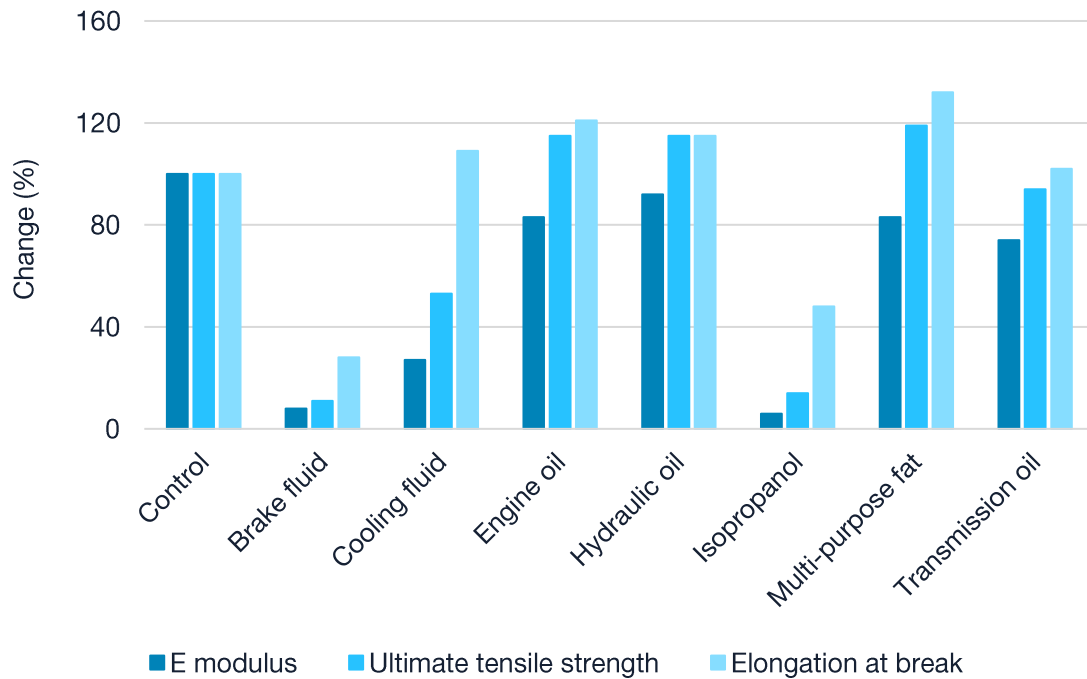
## Mechanical Testing

### 30 minutes



Change in mechanical properties after 30 minutes immersion

### 7 days



Change in mechanical properties after 7 days immersion

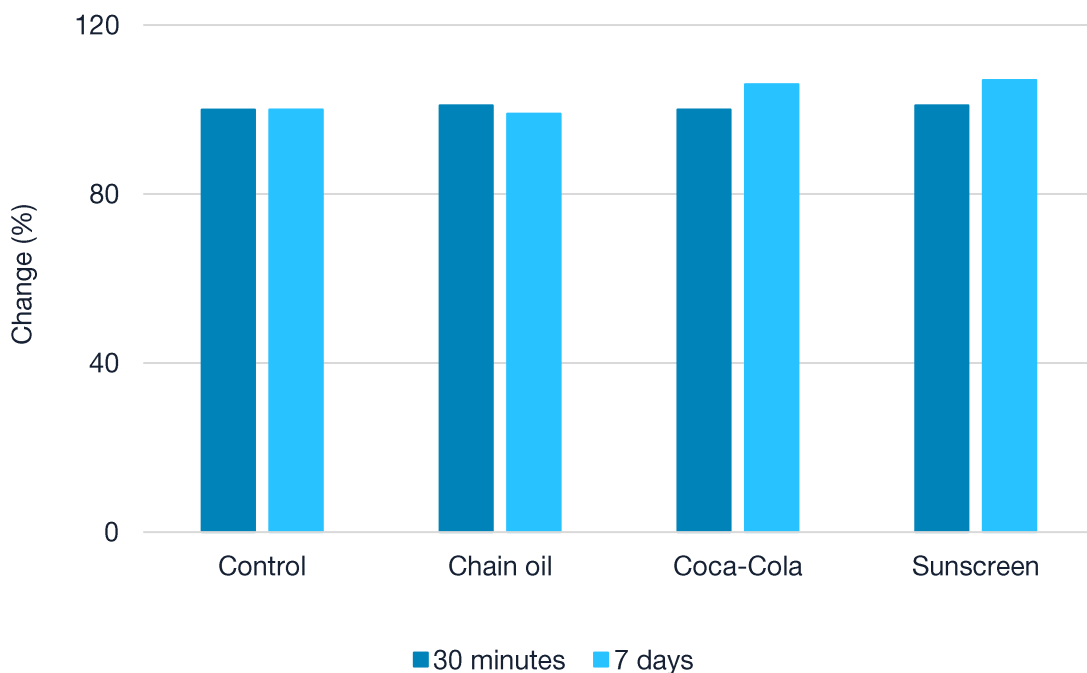
## Consumer Chemical Resistance

Similar to the industrial sector, different consumer applications may also require resistance against various chemicals, solvents and other contact substances. Testing for these application-specific requirements helps to evaluate the suitability of photopolymers for the intended use.

### Test Method and Specimens

ASTM D412 C tensile bars and shore A samples were soaked in each fluid at room temperature, one set for 30 minutes and one set for 7 days. Upon completion of the soaking time, the parts were removed from the test fluid and were dried to measure the weight and the mechanical properties.

### Weight Measurement

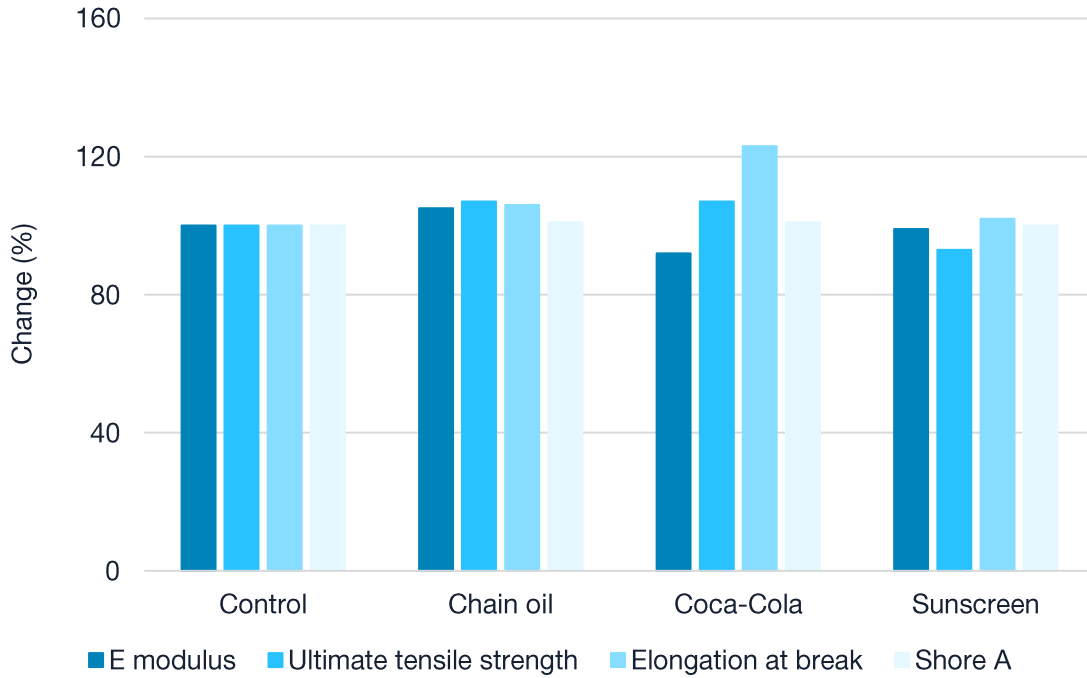


*Change in weight after immersion time*



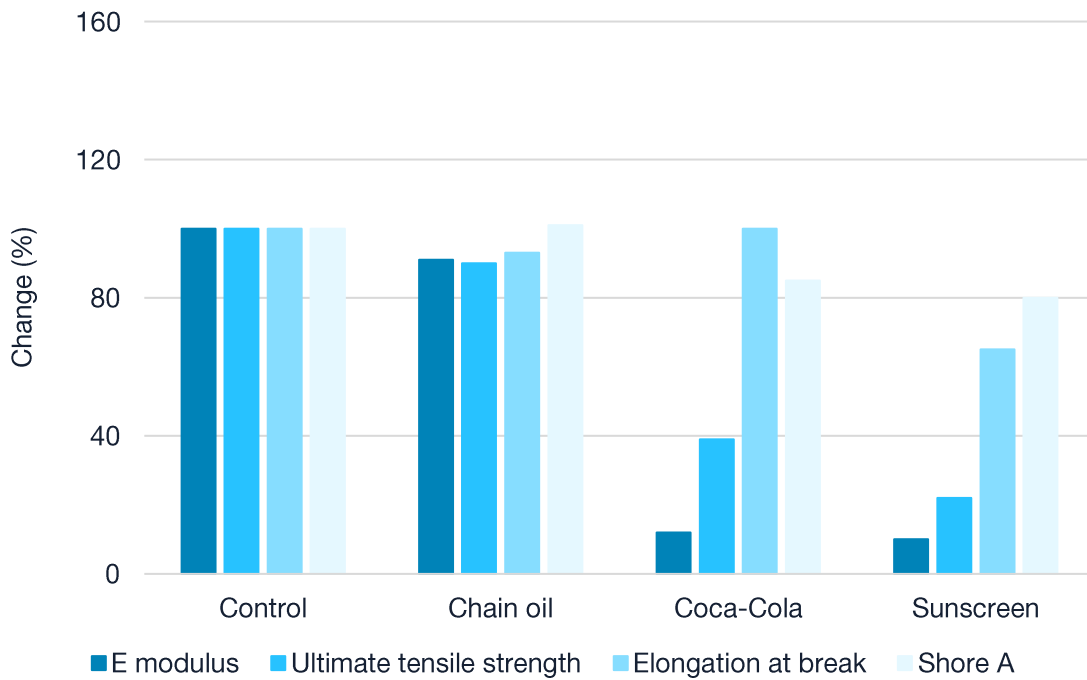
## Mechanical Testing

### 30 minutes



*Change in mechanical properties after 30 minutes immersion*

### 7 days



*Change in mechanical properties after 7 days immersion*

## Long-Term UV

Durability is a key feature for the components utilized within many industries, as they expect the materials used to withstand years of exposure to the elements. Through the effects of UV radiation, photopolymers can degrade over time. The aging can be caused by the influence of UV light, heat and water. The degree of ageing depends on duration and intensity.

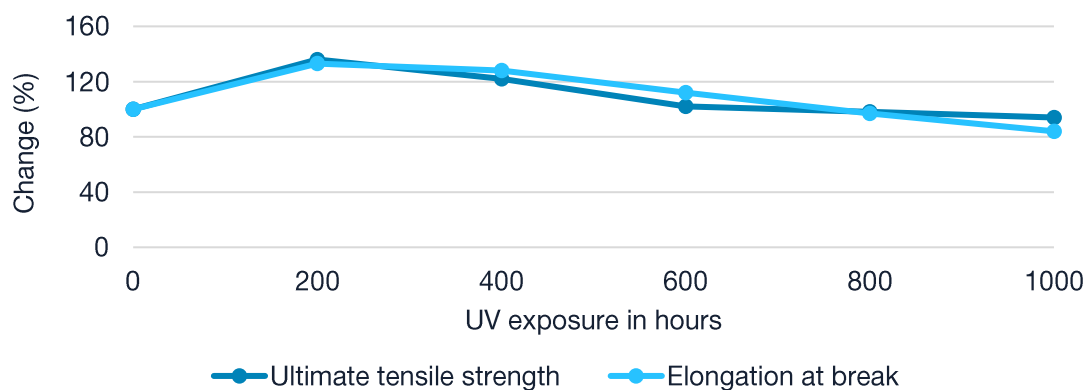
### Test Method and Specimens

The ageing tests were performed with ASTM D412 C tensile bars and color cones as per ISO 4892-2:2013 method A, cycle 1.

Cycle No.	Exposure period	Irradiance		Black standard temperature in °C	Chamber temperature in °C	Relative humidity in %
		Broadband (300 nm to 400 nm) in W/m <sup>2</sup>	Narrowband (340 nm) in W/(m <sup>2</sup> nm)			
1	102 min dry	60 ± 2	0.51 ± 0.02	65 ± 3	38 ± 3	50 ± 10
	18 min water spray	60 ± 2	0.51 ± 0.02	-	-	-

*Testing conditions for ISO 4892-2 method A, cycle 1*

### Mechanical Testing



*Change in mechanical properties after accelerated weathering*

The final values after 1000 hours of long-term UV exposure can be found below.

Property	Before long-term UV exposure	After 1000 hours of UV exposure
Ultimate tensile strength	11 MPa	10 MPa
Elongation at break	140%	117%

*Mechanical properties before and after 1000 hours of UV exposure as per ISO 4892:2 method A*

## Coloration

After being exposed up to 1000 hours, only slight additional yellowing compared to the reference sample could be detected.



*Effect of UV exposure on color of the specimens*

# Biocompatibility

**Product: Ultracur3D® EL 4000**

Revision: 02<sup>nd</sup> of February 2022

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**3D printed test items of the above stated product have fulfilled the requirements of tests as stated below:**

**Cytotoxicity Testing- Neutral Red:**

(EN ISO 10993-5 (2009))

The biocompatibility tests were recorded on test specimen of the referenced product to show compatibility of the material in general. The biocompatibility tests listed are not part of any continuous production protocol. The test assessments reflect only the test specimen and have to be retested on the final product. It remains the responsibility of the de-vice manufacturers and /or end-users to determine the suitability of all printed parts for their respective application.

**For notice:**

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